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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/589,996	02/05/2007	Michiel T. Kreutzer	63611A	6871

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The Dow Chemical Company
Intellectual Property Section
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EXAMINER	
HANLEY, SUSAN MARIE	
ART UNIT	PAPER NUMBER
1651	
MAIL DATE	DELIVERY MODE
08/03/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/589,996	KREUTZER ET AL.	
	Examiner	Art Unit	
	SUSAN HANLEY	1651	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 June 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) *9 and 18-20* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8 and 11-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *01/22/2007*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of the specie of claim 8, wherein the catalyst is an enzyme, in the reply filed on 06/01/2009 is acknowledged. Claims 1-7 and 10-17 are generic.

Claims 9 and 18-20 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 06/01/2009.

Claims 1-8 and 10-17 are presented for examination.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-8 and 10-17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 is rejected because the term "thin" is a relative term and no comparison is made.

Claim 1 recites the limitation "monolithic ceramic honeycomb" in 13. There is insufficient antecedent basis for this limitation in the claim.

Claim 15 is rejected because the term "acicular" lacks antecedent basis in claim 1.

Claims 2-8 and 10-14 and 16 are rejected because they are dependent claims that do not overcome the deficiencies of the rejected independent claim from which they depend.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 1 is directed to a method for forming a reaction product by flowing a reactant into a ceramic honeycomb having an inlet and outlet that are connected by adjacent channels having thin porous walls such that the liquid substantially penetrates the into the walls and the reactant reacts as the liquid containing the reactant flows from the inlet to the outlet of the monolithic ceramic honeycomb and recovering the product from the outlet end of the ceramic honeycomb. Claim 8 is directed to the elected specie, an enzyme. Claims 12 and 13 are directed to using a solvent that is water.

Claims 1, 8, 12 and 13 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Kobayashi (Sho58-150322; cited in the IDS filed 01/22/2007; translation).

Kobayashi teaches that microorganisms which contain enzymes (page 3, third full paragraph; claim 8) are attached to ceramic honeycomb structure via a polysaccharide (claim 1, lines 8 regarding the attachment of the enzymes (microorganisms) to the ceramic structure. The ceramic honeycomb structure is

advantageous because the surface is optimal for fixing microorganisms thus guaranteeing a large contact surface area with minimal pressure loss (page 3, 4th full paragraph). The fixed microorganisms have a high mechanical strength and can be used continuously for a long time (page 4, third full paragraph). Kobayashi teaches that the walls of the honeycomb are perforated with holes on the ceramic honey comb structure to avoid the problem of obstruction and to increase contact surface area (page 3, end of the fourth full paragraph; instant claim 1, lines 7-9 regarding the thin porous partition walls and the flow of the reactant). The wall surface of the ceramic honeycombed structured body has multiple parallel holes (meeting the limitation of channels of a plurality of porous partition walls and is therefore monolithic (claim 1).

A aqueous glucose (the reactant) solution (claims 12 and 13 directed to a water solvent) was introduced from the bottom of a reactor containing the immobilized microorganisms thus meeting the limitation of an inlet. Fermentation was accomplished using yeast and the ethanol genrated at the reactor outlet (meeting the limitation of an outlet) was measured and compared. Thus, the ethanol was recovered as in limitation 1(b).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 8, 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Duncombe et al. (US 4,430,348) in view of Kobayashi (Sho58-150322; cited in the IDS filed 01/22/2007; translation).

The content of the claims is discussed supra.

Duncombe discloses a method for the production of a superattenuated low calorie beer that is produced by fermenting beer though glucoamylase immobilized on a ceramic monolith (abstract of the patent; instant claim 8, the specie for the catalyst is an enzyme; it is disposed on the ceramic surface as in instant claim 1). The limit dextrins (the reactants) are hydrolyzed by the immobilized glucoamylase by passing the beer through said monolith which is porous (see figure 2; lines 7 of instant claim 1) such that the limit dextrins come into contact with said glucoamylases that are immobilized on the ceramic surface (claim 1 of the patent). The reactor consists of a ceramic monolith having a number of discrete openings or cells within an external core. For enzyme immobilization, the maximum surface area (large number of small cells per unit cross-section) is desired so that the maximum amount of enzyme can be attached and the reactor size can be minimized (col. 5, lines 25-36).

The reactor consists of an enzyme reactor tank having a cylindrical main body in which the ceramic monolith is disposed. The tank has a inlet at the bottom and an outlet at the top (hence it is a flow through apparatus, as required by instant claim 1). The enzyme reactor is positioned next to and is in liquid communication with a fermentation tank (col. 7, lines 30-65). In use, the fermenting beer which contains

suspended yeast cells is pumped from the fermentation tank into the enzyme reactor and back to the fermentation tank. Hence, the fermentation tank receives the products of the enzyme reactor and therefore said products are recovered from the reactor tank that contains the immobilized enzyme, as in instant claim 1, part (b). The liquid is beer which contains water as in instant cams 12 and 13.

Duncombe does not teach that the structure of the cells is a honeycomb.

The disclosure by Kobayashi is discussed supra.

It would have been obvious to one of ordinary skill in the art, a biochemist, at the time the invention was made to use a honeycomb ceramic structure are perforated with holes on the ceramic honey comb structure for the ceramic monolith in the method of Duncombe. The ordinary artisan would have been motivated to do so because the honeycomb structure optimizes the surface area thus guaranteeing a large contact area while minimizing pressure loss. The use of the honeycomb structure would naturally allow for the penetration of the liquid containing the reactant, limit dextrin, to flow from the inlet to the outlet, thus, undergoing reaction (lines 9-12 of instant claim1, regarding the penetration of the liquid into the walls of the honeycomb). The ordinary artisan would have had a reasonable expectation that enzymes immobilized on a honeycomb ceramic monolith would successfully carry of the desired glucoamylase reaction because Kobayashi demonstrates that microorganisms which are immobilized in this manner have the desired activities (Example 1). The ordinary artisan would have known from the combined references that microorganisms and enzymes can both be immobilized on ceramic surfaces for the purpose of catalyzing biochemical reactions.

Claims 1-8, 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Duncombe et al (US 4,430,348) in view of Kobayashi (Sho58-150322; cited in the IDS filed 01/22/2007) as applied to claim1, 8, 12 and 13 above, and further in view of Bliss et al. (US 2005/0159308).

The disclosure by the combination of Duncombe and Kobayashi is discussed supra.

The combined disclosures do not teach that the monolithic ceramic honeycomb has a porosity of about 50% and a pore size of at least about 5 micrometers (claim 2); that the liquid containing the reactant penetrates in an amount that is at least 10% of the static liquid fraction as determined using the resident time distribution obtained under Taylor flow of a tracer pulsed into the liquid (claim 3); that the amount in claim 3 is at least about 15% of the static liquid fraction (claim 4); that the method has a mass exchange as calculated using an E-curve at is at least about 0.4 % (claim 5); that the mass exchange is at least about 0.7 (claim 6) or that the static liquid fraction is at least about 1.25 (claim 7).

Bliss discloses that a multicellular ceramic honeycomb that supports a catalyst has an in let and an outlet end and a multiplicity of mutually adjoining cells extending along the length of the body. Typically, the wall pore size ranges between about 0.1 to 100 micrometers, preferably between about 1 to 40 micrometers while the wall porosity typically ranges between about 15-70%, preferably between about 25 to 50% (paragraph [0019]). The disclosure of the pore sizes by Bliss overlaps the claimed range

of 5 micrometers or more. The porosity disclosed by Bliss overlaps the claimed range of 50% or more (instant claims 2 and 15).

It would have been obvious to one of ordinary skill in the art, a biochemist, at the time the invention was made to make the porosity and the pore size of the monolithic ceramic honeycomb disclosed by Duncombe and Kobayashi about 50% and at least about 5 micrometers, respectively. The ordinary artisan would have been motivated to do so because such values are disclosed by the prior art as being typical sizes and porosity for ceramic honeycomb flow through reactors that support a catalyst. The ordinary artisan would have had a reasonable expectation that said pore size and porosity would be successful in the method of the combined disclosures because they are recognized by the prior art as being typical sizes for ceramic honeycomb flow through reactors that supports a catalyst.

Regarding the limitations of claims 3-7, said limitations naturally flow from the factors of pore size and porosity of the monolithic ceramic honeycombed reactor since said factors govern the flow of a liquid through a honeycomb structure. In this case, the burden is shifted to Applicant to distinguish the claimed invention from the cited prior art. It is noted that In re Best (195 USPQ 430) and In re Fitzgerald (205 USPQ 594) discuss the support of rejections wherein the prior art discloses subject matter which there is reason to believe inherently includes functions that are newly cited or is identical to a product instantly claimed. In such a situation the burden is shifted to the applicants to "prove that subject matter shown to be in the prior art does not possess characteristic relied on" (205 USPQ 594, second column, first full paragraph).

Claims 1-8, 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi (Sho58-150322; cited in the IDS filed 01/22/2007) as applied to claim1, 8, 12 and 13 above, in view of Bliss et al. (US 2005/0159308).

The disclosure by Kobayashi is discussed supra.

Kobayashi does not teach that the monolithic ceramic honeycomb has a porosity of about 50% and a pore size of at least about 5 micrometers (claim2); that the liquid containing the reactant penetrates in an amount that is at least 10% of the static liquid fraction as determined using the resident time distribution obtained under Taylor flow of a tracer pulsed into the liquid (claim 3); that the amount in claim 3 is at least about 15% of the static liquid fraction (claim4); that the method has a mass exchange as calculated using an E-curve at is at least about 0.4 % (claim 5); that the mass exchange is at least about 0.7 (claim 6) or that the static liquid fraction is at lest about 1.25 (claim 7).

The disclosure by Bliss is discussed supra.

It would have been obvious to one of ordinary skill in the art, a biochemist, at the time the invention was made to make the porosity and the pore size of the monolithic ceramic honeycomb disclosed by Kobayashi about 50% and at least about 5 micrometers, respectively. The ordinary artisan would have been motivated to do so because such values are disclosed by the prior art as being typical sizes and porosity for ceramic honeycomb flow through reactors that support a catalyst. The ordinary artisan would have had a reasonable expectation that said pore size and porosity would be successful in the method of the combined disclosures because they are recognized

by the prior art as being typical sizes for ceramic honeycomb flow through reactors that supports a catalyst.

Regarding the limitations of claims 3-7, said limitations naturally flow from the factors of pore size and porosity of the monolithic ceramic honeycombed reactor since said factors govern the flow of a liquid through a honeycomb structure. In this case, the burden is shifted to Applicant to distinguish the claimed invention from the cited prior art. It is noted that In re Best (195 USPQ 430) and In re Fitzgerald (205 USPQ 594) discuss the support of rejections wherein the prior art discloses subject matter which there is reason to believe inherently includes functions that are newly cited or is identical to a product instantly claimed. In such a situation the burden is shifted to the applicants to "prove that subject matter shown to be in the prior art does not possess characteristic relied on" (205 USPQ 594, second column, first full paragraph).

Claims 1,8, 10-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Duncombe et al (US 4,430,348) in view of Kobayashi (Sho58-150322; cited in the IDS filed 01/22/2007) as applied to claims 1, 8, 12 and 13 above, and further in view of van den Broecke et al. (WO 02/33048).

The combined disclosures by the combination of Duncombe and Kobayashi are discussed supra.

The combined disclosures do not teach that one of the reactants is a gas that is bubbled concurrently with the liquid.

van den Broecke teaches that fermentation processes involve the culturing of microorganisms, including yeast, and require a supply of oxygen for the aerobic metabolism of said microorganisms. Hence, oxygen is a reactant since the microorganisms require it for the fermentation process (instant claim 10). Usually the oxygen is supplied by passing an oxygen-containing gas such as air, though the liquid in the fermentation vessel. The oxygen is transferred from the gas bubbles (instant claim 11) to the liquid phase thus allowing its uptake by the microorganism (page 1, lines 6-14).

It would have been obvious to one or ordinary skill in the art, a biochemist, at the time the invention was made to supply oxygen in the form of air to the yeast in the enzyme bioreactor of Duncombe by bubbling it into said bioreactor. The ordinary artisan would have been motivated to do so in order to optimize the reaction between the limit dextrose and the immobilized glucoamylase. The ordinary artisan would have realized that oxygen is essential for the metabolic fermentation by the circulating yeast in order to produce the limit dextran. The ordinary artisan would have had a reasonable expectation that bubbling air through the enzyme reactor of Duncombe would aid in the fermentation and subsequent reaction of the products of the fermentation by the immobilized glucoamylase because microorganisms are known to have an obligate requirement for oxygen for the fermentation process.

Claims 1,8, 10-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi (Sho58-150322; cited in the IDS filed 01/22/2007) as applied to claims 1, 8, 12 and 13 above, in view of van den Broecke et al. (WO 02/33048).

The disclosures by Kobayashi is discussed supra.

Kobayashi does not teach that one of the reactants is a gas that is bubbled concurrently with the liquid.

The disclosure by van den Broecke is discussed supra.

It would have been obvious to one or ordinary skill in the art, a biochemist, at the time the invention was made to supply oxygen in the form of air to the yeast in the microorganism bioreactor of Kobayashi by bubbling it into said bioreactor. The ordinary artisan would have been motivated to do so in order to optimize the reaction between the glucose and the immobilized yeast. The ordinary artisan would have realized that oxygen is essential for the fermentation by the immobilized yeast in order to produce the ethanol. The ordinary artisan would have had a reasonable expectation that bubbling air through the microorganism reactor of Kobayashi would aid in the fermentation because microorganisms are known to have an obligate requirement for oxygen for the fermentation process.

Claims 1, 8, 12-14, 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Duncombe et al (US 4,430,348) in view of Kobayashi (Sho58-150322; cited in the IDS filed 01/22/2007) as applied to claims 1, 8, 12 and 13 above,

and further in view of Shiraishi (Hei 5-273119; cited in the IDS filed 1/22/07; translation) and Bliss et al. (US 2005/0159308).

The combined disclosures by the combination of Duncombe and Kobayashi is discussed supra.

The combined disclosures do not teach that the monolithic ceramic honeycombed is an acicular ceramic such as acicular mullite wherein the acicular mullite has a mean pore size of at least about 5 micrometers.

Shriaishi discloses that mullite is suitable for the attachment of enzymes or microorganisms or enzymes for such a carrier. Chitosan film is easily bonded to the ceramic carrier with strong adhesion in order to support the microorganism or enzyme (page 2 of the translation, under the heading "Constitution"). The mullite is an a turf-like state that is gown from needle (acicular) crystals in a highly dense state (page 2 of the translation under claim 2). The resulting ceramic carrier can support a thin film which is outstanding for the permeability of liquids (page 4, paragraph [0004]. Glucoamylase was successfully attached to said acicular mullite covered with chitosan. The fixed enzyme successfully converted starch into glucose (Example 3, page 5 of the translation).

It would have been obvious to one of ordinary skill in the art, a biochemist, to make the honeycomb ceramic monolith of the combined disclosures out of acicular mullite. The ordinary artisan would have been motivated to do so because the adhesion of enzymes via chitosan to the acicular mullite provides a dense surface that supports the enzymes which is outstanding for the permeability of liquids. The ordinary artisan would have had a reasonable expectation that the enzymes would be active when

attached to acicular mullite because Shiraishi teaches that fixed glucoamylase was able to convert starch into glucose.

The disclosure by Bliss is discussed supra.

It would have been obvious to one of ordinary skill in the art, a biochemist, at the time the invention was made to make the pore size of the acicular mullite ceramic honeycomb disclosed by Duncombe, Kobayashi and Shiraishi at least about 5 micrometers. The ordinary artisan would have been motivated to do so because such values are disclosed by the prior art as being typical pore sizes for ceramic honeycomb flow through reactors that support a catalyst. The ordinary artisan would have had a reasonable expectation that said pore size would be successful in the method of the combined disclosures because said pore size is recognized by the prior art as being typical sizes for ceramic honeycomb flow through reactors that supports a catalyst.

Claims 1, 8, 12-14, 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi (Sho58-150322; cited in the IDS filed 01/22/2007) as applied to claims 1, 8, 12 and 13 above, and further in view of Shiraishi (Hei 5-273119; cited in the IDS filed 1/22/07; translation) and Bliss et al. (US 2005/0159308).

The disclosure by Kobayashi is discussed supra.

Kobayashi does not teach that monolithic ceramic honeycombed is an acicular ceramic such as acicular mullite wherein the acicular mullite has a mean pore size of at least about 5 micrometers.

The disclosure by Shiraishi and Bliss are discussed supra.

It would have been obvious to one of ordinary skill in the art, a biochemist, to make the honeycomb ceramic monolith of Kobayashi out of acicular mullite. The ordinary artisan would have known from Shiraishi that microorganisms, like enzymes can be fixed onto ceramics via a polysaccharide. The ordinary artisan would have been motivated to make the honeycomb ceramic monolith of Kobayashi out of acicular mullite because the adhesion of microorganisms via a polysaccharide to the acicular mullite provides a dense surface that supports the microorganisms which is outstanding for the permeability of liquids. The ordinary artisan would have had a reasonable expectation that the microorganisms would be active when attached to acicular mullite because Shiraishi teaches that fixed glucoamylase was able to convert starch into glucose and Kobayashi teaches that microorganisms attached to ceramics are active.

It would have been obvious to one of ordinary skill in the art, a biochemist, at the time the invention was made to made to make the pore size of the acicular mullite ceramic honeycomb disclosed by Kobayashi and Shiraishi at least about 5 micrometers. The ordinary artisan would have been motivated to do so because such values are disclosed by the prior art as being typical pore sizes for ceramic honeycomb flow through reactors that support a catalyst. The ordinary artisan would have had a reasonable expectation that said pore size would be successful in the method of the combined disclosures because said pore size is recognized by the prior art as being typical sizes for ceramic honeycomb flow through reactors that supports a catalyst.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SUSAN HANLEY whose telephone number is (571)272-2508. The examiner can normally be reached on M-F 9:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Wityshyn can be reached on 571-272-0926. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Sandra Saucier/
Primary Examiner, Art Unit 1651

/Susan Hanley/
Examiner, Art Unit 1651